REMARKS

Applicant is in receipt of the Advisory Office Action mailed August 9, 2004.

Rejections Under Section 103 (in the Final Office Action mailed April 22, 2004)

Claims 1-4, 6-12, 14-19 and 21-24 were rejected under 35 U.S.C. Section 103(a) as being unpatentable over Baker et al. (USPN 6,219,070; hereafter referred to as Baker) and further in view of Thayer (USPN 5,278,949).

Claims 5, 13, and 20 were rejected under 35 U.S.C. Section 103(a) as being unpatentable over Baker et al. (USPN 6,219,070; hereafter referred to as Baker) and Thayer (USPN 5,278,949) as applied to claim 1 above, and further in view of Dye (USPN 5,684,941).

Claim 1 as amended recites:

"A method for rendering a polygon, the method comprising:
receiving geometry data defining vertices of the polygon,
computing initial vertex x,y values at end points proximate to each of the vertices of the polygon, wherein the end points define the outer edges of the first and last span that traverse the polygon;
computing a slope along each edge of the polygon, wherein said computing a slope introduces an error in each computed slope value due to the limited number of precision bits used to represent the slope value;
interpolating equally spaced x,y values along each respective edge of the polygon, wherein each of the x,y values specify the edge of sequential spans traversing the polygon, wherein said interpolating uses the computed slope along the respective edge of the polygon, and wherein the last x,y values in the sequence for each edge have an accumulated error due to the error in each respective computed slope value; and
storing final x,y values for each respective edge of the polygon, wherein, for each respective edge, said storing final x,y values comprises storing the interpolated x,y values for non-end points of the respective edge, and said storing final x,y values comprises storing the computed initial vertex x,y values for at least one of the end points of the respective edge, instead of the corresponding last interpolated x,y values."

Applicant's patent application describes a system and method for dealing with the accumulated error that results when an imprecise value for the slope of an edge of a

10

polygon is used to determine the repeated spacing along the respective edge of locations defining the edge of spans that traverse the polygon. Page 19, lines 7-26 of the application state:

> "Quantization error in slope calculation occurs due to the limited number of precision bits used to represent the slope dxdy or dydx along the edge. In cases where the mid or end vertices of a triangle lie on (or possibly close to) a grid point, this could result in the inclusion of an extraneous pixel or exclusion of a pixel within the triangle. This will result in imperfect meshing of triangles. This is shown in Figure 11, which demonstrates the actual and perceived edge. The thicker edge is the actual edge of the triangle and the lighter edge is the interpolated edge after traversal. As seen, the vertex M of the triangle located at (10,2) should ideally include the pixel (10,2) as part of the triangle. Due to inaccuracy in slope values and the interpolation of these inaccurate values, the pixel at (10,2) may be dropped. This would result in an artifact or "hole" in the rendered image.
>
> In one embodiment of the invention, the system operates to use the defined values (the computed initial vertex x,y values) for the end points. The walking of the edge starts from one end point, adding the quantized slope value along the way, and when the other end is reached, the user defined value (the computed initial vertex x,y value) for that end point is used to replace the interpolated value. This method of "snapping" back to the original defined location eliminates all the holes in a triangle mesh that could have resulted otherwise. This scheme removes or prevents holes in triangle meshes. In the above case, the interpolated value (9.xxx,2.xxx) is replaced with (10,2). This will assure the proper rendering of the triangle." (*Underlining Added.*)

Neither Baker nor Thayer either singly or in combination teach or suggest the limitations of claim 1 that state, "computing initial vertex x,y values at end points proximate to each of the vertices of the polygon, wherein the end points define the outer edges of the first and last span that traverse the polygon....".

In addition, neither Baker nor Thayer even mention the problem of accumulated errors in edge and span walking when using an imprecise value for an edge slope. Specifically, neither Baker nor Thayer either singly or in combination teach or suggest the limitations of claim 1 that state, "computing a slope along each edge of the polygon, wherein said computing a slope introduces an error in each computed slope value due to the limited number of precision bits used to represent the slope value; interpolating equally spaced x,y values along each respective edge of the polygon, wherein each of the x,y values specify the edge of sequential spans traversing the polygon, wherein said

11

interpolating uses the computed slope along the respective edge of the polygon, and wherein the last x,y values in the sequence for each edge have an accumulated error due to the error in each respective computed slope value; and ...".

Thayer does describe a method that involves repeatedly adding the slope of each edge (but does not mention accumulated position errors) in column 9, lines 25-49:

> As shown in FIG. 3, the rendering circuitry 308 preferably comprises edge stepper 308a, X stepper 308b and color interpolation circuitry 308c. As will be described in more detail below, Draw Trapezoid commands are interpreted by edge stepper 308a and trapezoids and vectors are rendered as described. Other commands are sent down the graphics pipeline to the remaining blocks of the rendering circuitry 308 or to other downstream systems. Generally, when a trapezoid or vector is to be drawn, the edge stepper 308a steps down the raster scan lines in Y coordinate steps and computes the XZ coordinate intersections of the edges with each scan line. The slope of each edge, which is provided as the aforementioned Y slope and Z slope values, is provided by upstream hardware and is repeatedly added to the X and Z intersections of the previous scan line to determine the current X and Z intersections. If such capability is provided, perspective correction factors (W values) are similarly computed along each edge. The edge stepper 308a thus generates span limits for each scan line in the trapezoid where a span limit consists of a Y value (the scan line) and the X, Z and W intersections of each edge with the scan line. A preferred embodiment of edge stepper 308a will be described in more detail below with respect to FIG. 5. (*Underlining Added.*)

Baker describes a method that utilizes even less precision by rounding the slope to integer values (but does not mention accumulated position errors) as stated in column 13 line 56 through column 14, line 10:

> "During the iterative process of selecting test points along long edge 510', edge walker 136 starts with an initial value P.sub.0.times.Q.sub.0 and iterates this value along the long edge for each increment of y. In each iteration, y is incremented by 1 and x is incremented by Dx, which is the geometric slope along the long edge. The geometric slope is the difference in the x coordinates divided by the difference in the y coordinates along the long edge, which is typically a fractional value. Since triangle engine 123 is not configured to select test points having fractional subpixel coordinates in this embodiment, Dx is rounded to its nearest integer. The direction of the rounding, up or down, depends on the scan direction of the triangle. The scan direction is the direction in which edge walker 136 successively selects test point along lines parallel to the x axis during the iterative process to be more fully described below. The triangles are scanned from left-to-right if the long edge of the triangle is on the left (as in the present example). Dx is to be rounded down to the next integer for left-to-right scanning.

12

Triangles are scanned from right-to-left if the long edge is on the right of the triangle. Dx is to be rounded up to the next integer for right-to-left scanning." (*Underlining Added.*)

Moreover, neither Baker nor Thayer either singly or in combination teach or suggest the limitations of claim 1 that state, "computing initial vertex x,y values at end points proximate to each of the vertices of the polygon, wherein the <u>end points define the outer edges of the first and last span that traverse the polygon</u> ....storing final x,y values for each respective edge of the polygon, wherein, for each respective edge, said storing final x,y values comprises storing the interpolated x,y values for non-end points of the respective edge, and said <u>storing final x,y values comprises storing the computed initial vertex x,y values for at least one of the end points of the respective edge, instead of the corresponding last interpolated x,y values</u>".

Therefore claim 1 and its dependents are non-obvious and patentably distinguished over Baker and Thayer for at least the reasons stated above. Claims 8 and 17 recite features similar to the features of claim 1, and thus these claims and their dependents are also non-obvious and patentably distinguished over Baker and Thayer based on similar reasoning. New claims 25-27 recite features similar to the features of claim 1, and thus these claims are also non-obvious and patentably distinguished over Baker and Thayer based on similar reasoning.

CONCLUSION

In light of the foregoing amendments and remarks, Applicant submits the application is now in condition for allowance, and an early notice to that effect is requested.

If any extensions of time (under 37 C.F.R. § 1.136) are necessary to prevent the above referenced application(s) from becoming abandoned, Applicant(s) hereby petition for such extensions. If any fees are due, the Commissioner is authorized to charge said fees to Meyertons, Hood, Kivlin, Kowert & Goetzel PC Deposit Account No. 50-1505/5181-89200/JCH.

Also enclosed herewith are the following items:

☒ Return Receipt Postcard

☒ Request for Continued Examination

Respectfully submitted,

Mark K. Brightwell

Mark K. Brightwell
Reg. No. 47,446
AGENT FOR APPLICANT(S)

Meyertons, Hood, Kivlin, Kowert & Goetzel PC
P.O. Box 398
Austin, TX 78767-0398
Phone: (512) 853-8800

Date: Aug. 20, 2004 MKB/(jwc)

14